THE AMERICAN MINERALOGIST

VOL. 3 JANUARY, 1918 No. 1

QUARTZ CRYSTALS FROM CENTERDALE, RHODE ISLAND

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Houston, Texas

AT Centerdale, about three miles west of Providence, Rhode Island, there occur quartz crystals showing an unusual number of forms. The rock in which they are found is a green schist, composed principally of bladed hornblende, somewhat altered to chlorite. There is an intrusive granite nearby, and pegmatite stringers and quartz veins from it cut the schist. The quartz crystals occur in small open cavities, and have doubtless been formed by hot solutions emanating from the granite. They are normally clear and colorless, but at times are more or less filled with tiny plates of chlorite, giving them a green color. Their complex form may be the result of the presence of so much chloritic material in the solutions from which they crystallized. All are right-handed, and twinned, as shown by repetition of trigonal pyramid faces on adjacent corners.

One of these crystals was submitted to measurement on the two-circle goniometer at Harvard University, and the writer's thanks are herewith extended to Professor Palache for his kind help in this work. The crystal was centered so that the reflections from the prism faces all fell on the vertical cross-hair, and the position of a possible basal plane was calculated by adding 90° to the angular position read on the horizontal circle for the prism. The values of the phi (φ) angle for each form were measured from one prism face, those of the rho (ρ) angle from this calculated base. The forms whose presence seems definitely established, with a few of their angular measurements, are listed here:

Prism *m* $(10\bar{1}0)$; usual rhombohedrons *r* $(10\bar{1}1)$ and *z* $(01\bar{1}1)$.

Steep rhombohedron *f* $(40\bar{4}1)$; observed 4 times, rho = 77° 48′ to 79° 19′, calculated 78° 52′.

Steep rhombohedron *e* $(50\bar{5}1)$; observed twice, rho = 80° 56′ and 81° 20′, calcd. 81° 03′.

Trigonal pyramid *s* $(11\bar{2}1)$; obs. 4 times definitely, and once as a vicinal face.

Trapezohedrons: *F* $(21\bar{3}1)$; obs. twice, the best one yielding phi = 74° 02′, calcd. 73° 25′, and rho = 19° 33′, calcd. 19° 06′.

u $(31\bar{4}1)$; obs. twice, the best with phi = 13° 57′, calcd. 13° 54′, and rho = 77° 08′, calcd. 77° 41′.

x $(51\bar{6}1)$; obs. once, phi = 9° 37′, calcd. 8° 57′ and rho = 82° 29′, calcd. 81° 57′.

There are also other forms, but the measurements were not sufficiently accurate to certainly identify them; of these $(21\bar{3}5)$, $(31\bar{4}3)$, and $(32\bar{5}3)$ may be noted as possibilities.

LIMONITE PSEUDOMORPHOUS AFTER PYRITE FROM LANCASTER CO., PA.

H. L. WILLIG

Lancaster, Pa.

While the Boice farm is known to mineralogists all over the world by reason of the interesting specimens of pyrite found there, the report of a new locality where specimens in some respects similar in character and equalling in beauty and complexity those found at Boice's, will be of more than ordinary interest.

In Manheim township, Lancaster Co., Pa., immediately south of the Neffsville ridge and about three miles northwest of the city of Lancaster, are to be found loose in the soil nearly perfect pyritohedra, twinned pyritohedra showing reëntrant angles and combinations of cube, octahedron, and pyritohedron, of limonite pseudomorphous after pyrite.

The specimens from this locality are notable for their fine condition and size. Several specimens in the museum of Franklin and Marshall College, at Lancaster, measuring 40 x 40 mm. and 32 x 35 mm.; there is also a cube 83 mm. on one edge, but it is imperfect.

The color ranges from chestnut brown to deep purple-black and the crystals frequently show good luster on their faces.

FAMOUS MINERAL LOCALITIES. I. THE KEOKUK GEODE REGION

EDGAR T. WHERRY

Washington, D.C.

This paper represents the first of a series, one of which it is proposed to publish each month in this magazine. The object is to inform mineral collectors as to the present situation at localities from which in the past good specimens have been obtained. Contributions to this series are desired from any of our subscribers who are familiar with such localities. THE EDITORS.

WHEN the writer began the study of minerals, and became acquainted with some of the public and private collections in the city of Philadelphia, he was early impressed by the remarkable geodes lined with quartz and other minerals labeled as coming from Keokuk, Iowa. Reading of the back numbers of the *Mineral Collector* disclosed the fact that these objects had attracted much attention from collectors, and that many attempts had been made to explain their origin, without success. He looked forward to some day being able to visit the locality and see for himself how they occurred; and some fifteen years later, in the spring of 1917, a trip to the West furnished an opportunity. Meanwhile Professor Francis M. Van Tuyl, then at the University of Illinois, had taken up the study of this subject, written an elaborate account of the mode of occurrence of the geodes, and proposed a theory of their origin.[1]

The town of Keokuk is situated on the west bank of the Mississippi River about 175 miles north of St. Louis, and 40 miles south of Burlington, Iowa, which is 200 miles west of Chicago, and is best reached by taking the Burlington Railroad from one of these points. There would be nothing gained by giving exact schedules, as the times of trains are subject to change, but there are at least two express trains per day in each direction, which stop at Keokuk. Good hotel accommodations can be obtained there. One full day is ample time to visit the two best localities.

Altho geodes occur in many places in the vicinity of Keokuk, the cliff behind the railroad station showing a few of them by way of welcome to the visiting mineralogist, the best locality is about a mile west of the station, and is reached by

[1] *Am. J. Sci.* **42** (1), 34–42, 1916; see abstract in this number.

following Main Street northwestward to 10th St., turning southwest on the latter, crossing a ravine, and continuing to the valley of Soap Creek. On descending to the bank of this stream, and examining critically and destructively a few of the seeming cobblestones in its bed, the collector will soon discover the objects he is searching for. On ascending the stream in quest of their source, he will find a steep bank of shale dotted over with geodes of all sizes and conditions. An hour or two may be spent collecting here, but few specimens should be taken, space being reserved in the collecting bag for the results of the afternoon's trip.

Before the morning is over it will be well to tear one's self away from this locality, return to town, and take the interurban trolley car for Warsaw, Illinois, which lies across the Mississippi from Keokuk, but in the same geological formations. Warsaw may also be reached from Peoria, Illinois, by the Toledo, Peoria and Western Railway, but this route is not to be recommended if one's time is limited. From Warsaw station go eastward up the hill as far as the lane extending off from the main street just before the High School is reached, a trip requiring perhaps 15 minutes. Follow this lane northwards down into the valley cut by a tiny stream, and get busy.

The uppermost bed exposed is a dark-colored shale, containing a few small geodes lined with calcite, but a lighter colored rock beneath, exposed in the walls of the ravine for a short distance down stream, is the Geode Bed proper. Geodes can be found here by the hundreds,—the writer obtained a barrel full for the National Museum in three hours, and all first class, complete specimens at that. They occur in the stream bed, in the talus at the bottom of the cliffs, and in the rock ledges themselves. Where loosened by the frost they can easily be pried out from the soft rock, and some of the finest examples can be obtained in this way.

Not by any means all of the round stones in sight are geodes, however, as the collector will learn by experience. Many may have been so once, but are now solidly filled with crystalline quartz, and the absence of cleavage in this mineral is well illustrated by these. It is a good idea to lift a specimen before hitting it; the heaviness or lightness will usually give an indication as to how hard a blow may safely be struck, and, in doubtful cases, listening for the rattling of loose fragments inside when the stone is shaken, especially after a few light taps with the hammer to loosen things up, is an excellent guide.

One of the most remarkable features of the occurrence of these geodes is the fact that those found side by side in the bed are so diverse in character. One may be thin-shelled and lined with quartz, the next thick and lined with botryoidal blue chalcedony, another with calcite crystals implanted on the quartz, and the next one solid or nearly so; and yet all of these may be less than an inch from one another. Dr. Van Tuyl discussed this point in his paper, and pointed out two possible explanations, which are noted in the abstract; the second is the more probable.

Every winter the frost brings down numerous geodes from the cliffs, so at this locality the collector has no difficulty in getting something to take away; indeed the problem is rather what to leave. It is safe to load up heavily, however, as the route from here on is down stream and down grade, the trolley track being finally reached at a point a thousand feet or so from the station, where the results of the trip can be confided to the expressman. The writer had an exciting experience here. He hired a horse and buggy, bought a barrel and some paper, drove down the lane from the high school nearly to the stream, and loaded up. The barrel was filled in time to make the trip back to the station comfortably but on driving up the rough road the barrel fell out, and the whole job of packing had to be done over again. He reached the station and completed the freight shipment just one minute before the last car connecting with the train he planned to take left for Keokuk.

The writer was able to make the trip in the manner described, without waste of time in searching for the best localities, thru the kind advice and assistance of Professor Francis M. Van Tuyl and his brother, Mr. John E. Van Tuyl, of the Wilkinson Drug Co., in Keokuk, and takes this opportunity to thank them most heartily, and thru this article to extend similar aid to collectors who may pass that way in the future.

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Mr. W. Scott Lewis, of Los Angeles, California, finding his time too fully taken up otherwise to contribute actively toward the editing of this magazine, has resigned as associate editor.

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Mr. Hugh E. McKinstry writes from France that the most conspicuous geological feature there is mud, but that he hopes to find something beneath it eventually.

AN AMERICAN OCCURRENCE OF CRONSTEDTITE

CHARLES W. HOADLEY

Englewood, N. J.

On a recent trip of the New York Mineralogical Club, under the guidance of the writer, to the Hubbard tungsten mine at Long Hill (Trumbull Township), Connecticut, Mr. George E. Ashby found a specimen of a chlorite, determined by Mr. Lazard Cahn as cronstedtite, $4FeO.2Fe_2O_3.3SiO_2.4H_2O$. The specimen shows a group of black crystals $\frac{1}{8}$ inch in diameter with perfect basal cleavage, hardness = 3.5, and rhombohedral hemimorphic, with the forms c (0001) and x ($\bar{2}021$). This is believed to be the first occurrence of the mineral in the United States, the only known localities cited by Dana being Bohemia, England, and Brazil.

NOTES AND NEWS

We regret to note the death early in November of Professor Oscar C. S. Carter, who since 1880 had taught mineralogy and related subjects at the Philadelphia Central High School. He was the author of several contributions to local mineralogy.

We are also sorry to have to report the death on November 5 of Mr. Albert H. Petereit, the well-known dealer in minerals and gems of New York City.

PROCEEDINGS OF SOCIETIES

THE NEW YORK MINERALOGICAL CLUB

Midsummer excursion

On July 7, 1917, a party of 16 members of the N. Y. Mineralogical Club assembled at the Museum of the Staten Island Association of Arts and Sciences about 2 P. M. in response to an invitation extended to the Club by Dr. Arthur Hollick, director of the Museum, to inspect its collection of local minerals in which the various localities of the Richmond Borough of New York City, and especially the minerals of its serpentine exposures, are attractively represented. Amber of distinctively characteristic quality from certain clay deposits on the Island seemed also of special interest as an addition to the gem minerals occurring within the limits of New York City. After an inspection of the collections, which are housed at present in a former residential building, the attention of the visitors was directed to a nearby site where work upon a new "city building" for the Museum was then in progress.[1]

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[1] This building is now at time of writing (Dec., 1917) nearing completion and the transfer of the Museum exhibits will soon be effected.

From the Museum the party proceeded by trolley to the "Toedts Hill" limonite bed, formerly an iron mine.[2] Dr. Hollick led the visitors over the locality and described its important features while they collected specimens of the "shot ore" and earthy limonite, chlorite, talc and other minerals of interest.

THE opening meeting of the season of 1917–18 was held on Oct. 10 at the American Museum of Natural History, New York, with Dr. Geo. F. Kunz, president, in the chair, and an attendance of 23 persons.

Col. Washington A. Roebling, of Trenton, N. J., Mr. Frederick A. Canfield, of Dover, N. J., and Mr. Clarence S. Bement, of Philadelphia, Pa., were elected to honorary membership in the Club. The late Dr. J. Selden Spencer was formerly the only honorary member.

Dr. Edgar T. Wherry, being present, was invited to address the club and briefly explained his new research work in the Bureau of Chemistry. Mr. Samuel G. Gordon described an excursion to localities in North Carolina and Virginia.

In accordance with the announced subject of the evening Messrs. Hoadley, Broadwell, Manchester, Ashby and others then described various interesting exhibits of specimens they had acquired during the summer.

The entire company then adjourned to the "Age of Man Hall" in the Museum to participate in a reception to Mr. Donald B. MacMillan and his associates on the recent "Crocker Land Expedition" and inspect the collections acquired by the enterprise.

As a compliment to Dr. Daniel Strowbridge Martin, one of the founders of the Club, the second meeting of the season was at his residence, No. 644 Monroe St., Borough of Brooklyn, N. Y., on November 14, 1917, with Dr. Geo. F. Kunz in the chair and 22 persons present.

Letters were read from Messrs. Bement and Canfield, thanking the Club for their election to honorary membership and the latter expressing a desire to continue his active membership as well.

After an election of several new members and the disposal of the routine business the President appointed a committee to report upon some way for the Club to participate with other organizations in a proposed celebration of the birthday of the Abbe Hauy.

Dr. D. S. Martin then presented the announced feature of the evening, which was a description of the five separate collections of the Charleston Museum at Charleston, S. C. These are the General Collection; the Ural Collection (minerals of the Ural mountains obtained at an early date from the School of Mines of St. Petersburg); the Shepard Phosphate Collection; the Piedmont Collection (consisting of minerals occurring in the belt of crystalline rocks which extends southeast of the mountains from Virginia to Alabama) and the Carbon Collection, the two latter having been accumulated by Dr. Martin.

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[2] For various papers on S. I. serpentine and limonite occurrences see *Proc. Nat. Sci. Assn. S. I.*, vols. 1, 2, 4, 5, 6, 7, 8 and 9; and *Proc. S. I. Assn. Arts and Sci.*, vols. 1, 2, 3, 5 and 6. On the Toedts Hill locality, see HOLLICK, A., *Proc. S. I. Assn. Arts and Sci.*, 2 (Pt. 3), 144–147, 1908; and WOODS, J. O., *ibid.* 3, 48–51, 1909.

Dr. Martin's contribution was illustrated with numerous examples of the explanatory labels used for the collections.

The exhibition of specimens being then in order, Mr. Hoadley circulated the specimen described elsewhere in this number, as representing the first American occurrence of cronstedtite found by Mr. Ashby on Nov. 6, 1917, the occasion of the Club excursion to Trumbull, Connecticut. Mr. Cahn gave a brief description of the crystals.

The Secretary then exhibited the dried, hard and greatly shrunken gelatin from a test tube in which Liesegang's segregation rings of a precipitate had been produced and in which they still persisted.

With a vote of thanks to Dr. Martin, the meeting adjourned.

WALLACE GOOLD LEVISON, *Secretary*

THE NEWARK MINERALOGICAL SOCIETY

THE 18th regular meeting of the Newark Mineralogical Society was held at the Newark Technical School on Sunday, November 4.

After a short session meeting adjourned and annual meeting convened with J. Holzmann as temporary president. All the officers were reëlected, as follows: President, Dr. Chas. A. Colton; Vice-President, John Holzmann; Treasurer, H. M. Lehman; Secretary, Wm. H. Broadwell.

One application was received for membership and favorably acted upon. Dr. Colton gave a demonstration of testing minerals by acids, which proved very interesting. Several exhibits were shown during the meeting; among them were specimens from Australia, Hungary and Italy. The secretary exhibited a few specimens from W. Paterson, showing aragonite crystals on prehnite, an unusual combination. These specimens were from a large pocket lined with prehnite and, from the indications, had at one time been completely covered with aragonite, but the shot had jarred a large part of the aragonite loose and many crystals were found at the bottom of the pocket; five or six large handfuls of them were taken out in loose form.

On November 3 the secretary in company with Mr. Holzmann visited a spot on 210th St., New York City, where both obtained a quantity of well-formed crystals of malacolite, which were also exhibited at the meeting. This is a new locality, at least to the Newark members, and is well worth a visit by collectors, as that section of the city is being rapidly built up and in a few years it will be difficult to obtain any specimens there.

WM. H. BROADWELL, *Secretary*

THE PHILADELPHIA MINERALOGICAL SOCIETY

WAGNER FREE INSTITUTE OF SCIENCE, NOVEMBER 8, 1917

PRESIDENT LEFFMANN in the chair. Twelve members and two visitors present.

Mr. Harry W. Trudell spoke on "Collecting in North Carolina," describing the incidents experienced by himself and Mr. Gordon on a recent trip to

Hiddenite, Mt. Mitchell, and Spruce Pine, in North Carolina, and to Amelia Court House, Virginia, where they were joined by Dr. Wherry.

Mr. Trudell gave a humorous account of the experiences of the trip, illustrating his talk with numerous colored lantern slides and specimens. [This will be written up as the second of the series of articles on "Famous Mineral Localities" in the February number of this magazine.]

Mr. Gordon reported a trip to Beemerville, Sussex Co., N. J., Amity Orange Co., N. Y., and Paterson, N. J. The Amity region is one that has been pretty thoroly gone over, but a few specimens of small spinels, phlogopite, wernerite, hornblende, tremolite, chondrodite, etc., are obtainable occasionally in the stone fences that mark off the farms of the region.

At Paterson, in addition to material usually obtainable, there was found göthite, in small black balls on quartz (hitherto mistaken, at times, for diabantite). If the balls are broken they show the radiating structure, and are inside brown in color, but covered on the surface with a soft black powdery substance. Stevensite is abundant; but attention is called to the fact that slightly altered pectolite, especially if dark gray, is being called stevensite, whereas this term should be applied only to amorphous waxy material. Minutely crystallized thaumasite is abundant. Specimens were obtained of very minute crystals of anhydrite associated with small crystals of thaumasite and gypsum, the latter sometimes twinned.

Mr. Warford reported the Society's trip to Phoenixville. A few specimens of quartz, pyromorphite, barite, etc., were obtained. One of the old mines, the Montgomery, is to be reopened, the work of pumping it out having begun.

Samuel G. Gordon, *Secretary*

ABSTRACTS OF MINERALOGIC LITERATURE

THE GEODES OF THE KEOKUK BEDS. Francis M. Van Tuyl. *Am. J. Sci.* **42** (1), 34–42, 1916; abstract reprinted by permission from *Chem. Abstr.*, **10** (17), 2189–2190, 1916.

The geode bed consists typically of an impure siliceous dolomitic limestone at the base, usually containing large and well developed geodes, followed by an argillaceous shale with more numerous but less perfectly developed ones; both members are about 20 feet thick. The composition of the lower member at Keokuk is given. The primary minerals found in the geodes are quartz, chalcedony, calcite, aragonite, dolomite, ankerite, magnetite, hematite, pyrite, millerite, chalcopyrite, sphalerite, kaolinite, and bitumen; alteration products are limonite, smithsonite, malachite, and gypsum. Tabulation of 14 mineral successions observed shows the normal sequence to have been: first a thin chalcedonic shell formed, upon which deposited quartz or more chalcedony, followed by calcite and the minor minerals. The alternation of crystalline quartz and chalcedony in some geodes was probably produced by changes in the condition and amounts of SiO_2 supplied; changes in temperature and pressure cannot be appealed to because closely adjacent geodes frequently do not show the same alternations. The position of calcite is subject to variations; it usually rests on an inner lining of quartz or chalcedony; and in some geodes calcite of two generations appears, the earlier often brownish and associated with sphalerite. The geodes have been regarded by many authors as replacements of sponges or other organisms, but there is no evidence that they are to any extent of fossil origin at all; thus, of several thousand examined, only one was found which showed any trace of fossil structure, that one being an enlarged crinoid head. [The author does not review the various amateur explanations, which, tho almost incredibly absurd, are nevertheless interesting. One is the gas-bubble theory, according to which the geode cavities were made by carbon dioxide or other gases, like the bubbles in dough; another the ball-of-grass theory, according to which balls of grass were rolled about by the wind, and ultimately fell into the depositing sediments, late, decaying, leaving cavities (the absence of grass in the Mississippian period not being considered). A summary of old theories was published by Mr. Elmer Benge in the *Mineral Collector*, vol. 4, p. 97, 1897. EDITOR.]

The geodes are believed by Dr. Van Tuyl to be the result of replacement of calcareous concretions which are abundant in the beds in places, and have the same exterior form and relationships as the geodes. These were formed on the sea bottom, since lines of stratification do not pass thru them and no evidence of expansion is encountered about their borders. The process of solution must have begun in the interior and proceeded outward, for partially hollowed specimens are found. The most active solvents were probably CO_2 and H_2SO_4, the latter arising from the decomposition of pyrite. The kaolinite often found was evidently originally imbedded in the calcite of the nodules, and remained behind when the more soluble calcite dissolved. The calcite nodules must have been removed during a period when the beds were above ground-water level, and the deposition of the bulk of the minerals of the geodes when this level had again risen; this is shown to be in harmony with the known geologic relationships of the region. The second generation of minerals, chiefly calcite and pyrite, the bitumen, and the weathering products were evidently formed at a much later time. "The process of geodization evidently consisted of the inward growth of crystals upon the inside walls of cavities left by the solution of the imbedded concretions. The growth was necessarily accomplished by deposition from a solution which filled the interior completely. As this solution became depleted in its mineral content more was introduced by some process of diffusion and a continuous deposition resulted. In some instances a very impervious wall was developed, and growth must have been extremely slow; but in the majority of geodes numerous feeding channels in the walls afforded ready passage to the solutions after they penetrated the siliceous shells. The mineralogical variation of geodes which may occur in close proximity to each other is difficult to account for. It must either be assumed that the process of geodization was a very local one, and that each individual geode possessed only a small sphere of attraction, or that a peculiar localization of conditions favored in some instances the deposition of mineral matter more widely diffused thru the mineralizing solutions."

E. T. W.

EXCHANGE NOTICE

J. C. UTMAN, 701 2d Ave., E., Ashland, Wisconsin. Fine specimens of hematite, limonite, psilomelanite and other manganese minerals, native copper, and aragonite, from the Michigan iron and copper mines, offered in exchange for New England minerals, lead and zinc minerals, good calcite or quartz specimens.